Metallogenic and Tectonic Significance of mafic volcanism in the Early to Middle Jurassic Hazelton Group, northwestern British Columbia

TONY BARRESI[1], JARDA DOSTAL[2], AND JOANNE NELSON[3]
1. Department of Earth Sciences, Dalhousie University, Halifax NS, B3H 4J1 Canada <tbarresi@dal.ca> ¶ 2. Department of Geology, Saint Mary's University, Halifax NS, B3H 3C3 Canada ¶ 3. British Columbia Geological Survey, PO Box 9333 Stn. Prov. Gov't, Victoria BC, V8W 9N3 Canada

The Hazelton Group comprises the youngest pre-accretionary rocks of the Stikine terrane in NW British Columbia. The group is dominated by several successions of Early to Middle Jurassic subaerial and submarine calc-alkaline island-arc volcanic and sedimentary rocks. One of them, the Salmon River Formation (SRF), which represents a brief period of volcanic activity at the boundary between the Aalenian and Bajocian, is compositionally distinct. The SRF is host to three economic VMS deposits, including the world class Eskay Creek Ag-Au and base metal deposit, as well as over 60 other VMS prospects. The Formation is preserved as several fault-bounded erosional remnants or separate sub-basins along a 200 km belt. The ba-

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sins are filled with thick piles of pillow and pillow breccia basalt with minor amounts of rhyolite and sedimentary rock. Unlike other volcanic successions of the Hazelton Group, the SRF basalts are not accompanied by intermediate volcanics; they are island-arc tholeiites with a back arc basin affinity. There are two distinct varieties of the SRF basalt: type 1 basalts have a slight negative Nb anomaly accompanied by a slight depletion of the most incompatible elements, a flat REE pattern and absolute incompatible element abundances similar to MORB; type 2 basalts have moderate negative Nb and Ti anomalies, enrichment of the most incompatible elements, and a negative LREE slope. Epsilon Nd values for the basalts cluster between +3 and +4 (n=4) and between +6 and +7 (n=3). Type 1 basalts are the most juvenile isotopically; their +6 to +7 epsilon Nd values are unusual and represent a derivation from a more juvenile source than typical subduction-related basalt, whereas positive 3 to 4 epsilon Nd values of type 2 basalts are typical of Stikine Terrane island-arc volcanic rocks. Decompression melting of asthenospheric mantle is responsible for the type 1 basalts, whereas varying influences of subduction-modified lithospheric mantle account for the characteristics of type 2 basalts. The SRF basalts are critical to the formation of VMS deposits: i) heat from hypabyssal mafic magma bodies drove hydrothermal convection; ii) metals were scavenged from basalt in the volcanic pile; and iii) basalt caps the deposits aiding in preservation. The SRF has characteristics consistent with other VMS bearing bimodal-mafic dominated sequences (e.g., Kidd Creek and Noranda); it is associated with extensional, syn-volcanic structures and has geochemical features that are consistent with an extensional tectonic environment. Exploration for VMS deposits in the Hazelton Group should focus on a) targeting tracts of thick basalts; b) determining the structure of the depositional basin (i.e. syn-volcanic, graben or half-graben bounding faults); and c) geochemical analysis to determine the basalt characteristics. Only type 1 basalts are associated with known economic deposits in the SRF.